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ABSTRACT

The purposes of this study were to examine priority of recall of newly learned items (PRNI) from a developmental standpoint and to investigate whether preschool children are capable of using the attentional strategy employed by adults in free recall learning (FRL) of new items. In the first experiment the PRNI effect was examined from a developmental standpoint, using 160 subjects selected from middle-class settings and evenly divided on the basis of age into four groups: preschool, second grade, sixth grade, and adult. Two lists of unrelated words were constructed for each age group and presented orally at a one-second rate with a one-second interval between words. Subjects were allowed unlimited time for free oral recall. In the second experiment 20 males and 20 females with an average age of 4.7 were used as subjects. The procedures were the same as in the first experiment, with one exception. The subjects were instructed on how to use a PRNI strategy. The findings indicated an absence of PRNI at the preschool level and the presence of PRNI at the elementary and adult levels. Also, the fact that the amount of PRNI is related to age is supportive of the idea PRNI reflects the use of a relatively sophisticated learning strategy. (WR)

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A DEVELOPMENTAL STUDY OF A FREE RECALL LEARNING STRATEGY[1]

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The present finding of absence of priority of recall of newly learned items (PRNI) at the preschool level, and presence of PRNI at the elementary and adult levels, is seen as strengthening the position that the PRNI effect is a valid phenomenon and not a product of serial-position bias. Furthermore, the fact that the amount of PRNI is directly related to age is viewed as supporting the notion that PRNI reflects the use of a relatively sophisticated learning strategy, since one might expect older individuals to rely more heavily on such a strategy than younger individuals.

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A DEVELOPMENTAL STUDY OF A FREE RECALL LEARNING STRATEGY

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The present study is a developmental investigation of a free-recall learning strategy previously reported in research with adults and preschool children -- the strategy of priority of recall of newly learned items. Battig, Allen and Jensen (1965) demonstrated that in the multitrial free-recall learning (FRL) of lists of unrelated words, items recalled for the first time (New Items) tend to be recalled earlier than previously given items (Old Items). This finding is in opposition to the widely accepted notion of the strength principle which asserts that in situations where several responses are available, the stronger responses are among the first to occur. Battig et al. suggested that priority of recall of New Items, or PRNI, occurs because Ss adopt an attentional strategy during FRL in which New Items are discriminated from Old Items during list presentation and then are recalled early before they are forgotten. The apparent effect of such a strategy would be to maximize total recall by minimizing output interference which, presumably, is more detrimental to New Items than to Old Items. Other experimenters, however, argued against an attentional strategy interpretation of PRNI. Research by Postman and Keppel (1968) and others indicated that the PRNI effect was not necessarily the product of an attentional strategy as originally postulated by Battig et al. (1965). Rather these authors seemed to demonstrate that the early recall of New Items in FRL could be explained almost entirely by a serial-position bias operating mainly on the last few items of the FRL list. However, the notion that the PRNI effect is at least partially dependent on some kind of strategy used by Ss to maximize recall was effectively reinstated (e.g., Battig and Slaybaugh, 1969) in experiments in which PRNI was obtained under conditions controlling for position bias. Thus, studies to date, while acknow-

ledging the strong influence of recency on items (whether Old or New) occurring in the terminal serial positions, support the view that PRNI is in part due to the use of an attentional strategy.

Studies of PRNI in children were intended to provide further support for the attentional strategy hypothesis. This was based on the expectation of an increase in the use of such a strategy, hence an increase in PRNI, across age groups ranging from early childhood through adulthood. In the earliest study of the PRNI effect in children (Steinmetz and Battig 1969) this expectation was not supported since no differences were found in amount of PRNI in ages from 4-13 years. Since the Steinmetz and Battig study contained a procedural bias favoring a finding of PRNI, however, several experiments (e.g., Newman and Edmonston, 1973) were conducted which reexamined PRNI in the 4-5 year-old age group. No evidence of PRNI in this age group was found; on the contrary, results indicated that Ss of this age may produce the opposite effect in FRL of New Items -- priority of recall of Old Items (PROI).

There were two purposes for the present study: 1) to examine PRNI from a developmental standpoint; 2) to investigate whether preschool children are capable of using the attentional strategy employed by adults in FRL of New Items.

EXPERIMENT I

Method

Subjects. In the first experiment, the PRNI effect was examined from a developmental standpoint. An attempt was made to determine the presence or absence of PRNI at four age levels ranging from preschool through adulthood and to compare the size of the effect among age groups. One hundred and sixty Ss, selected from middle-class settings, were evenly distributed on the basis of age, in four groups: preschool (mean = 4.8 years), second grade (mean = 8.2 years), sixth grade (mean = 12.2 years), and adult (mean = 23.5 years). Each group contained an equal number of males and females who, with the exception of three

males and four females in the adult group, had no previous experience in verbal learning experiments.

Lists. Two lists of unrelated words were constructed for each age group, and, in order to balance for task difficulty, the lists varied in number of items as follows: 12 items for the preschoolers, 18 items for the second graders, and 16 items for both the sixth graders and adults. All words were selected from a pool of singular, monosyllabic nouns which are among the most frequently occurring words for preschoolers and adults.

Procedure. The words of each list were presented orally at a one-second rate with a one-second interval between words and Ss were allowed unlimited time for free oral recall. Two control procedures employed by Battig and Slaybaugh (1969) and Roberts (1969) were used to ensure that the results obtained could not be attributed to serial-position bias. The task was introduced to the preschool and second grade Ss as a game to be played with words. All Ss were told: "I'm going to read some words to you and when I finish, I'll ask you to say them back to me. You can say them in any order. Try to say as many as you can."

Results. Free-recall learning proceeded in the typical negatively accelerated fashion for each age group. The basic measure of PRNI used in this study was the standard recall rank score(s) (SRRS) developed by Battig et al., which reflects the position of an item given in recall relative to the median rank of the recall list. Positive SRRS reflect earlier than median recall and are evidence of PRNI; negative scores reflect later than median recall and are evidence of PROI.

SRRS for New Items. Based on the list length for each group, the percentage of words recalled at least once by Trial 7 was 88, 92, 94, and 97 for the preschool, second grade, sixth grade, and adult groups, respectively. An examination of the New Item SRRS revealed no main or interaction effects due to

testers, word lists, or sex of Ss. The preschoolers' mean SRRS of -.059 was not reliably less than the median recall rank of zero, t (39) = 1.14, $p > .10$. SRRS for the other three groups were significantly greater than zero with mean SRRS of .205 for the second graders, t (39) = 3.99, $p < .001$; .085 for the sixth graders, t (39) = 2.07, $p < .05$; and .284 for the adults, t (39) = 6.17, $p < .001$. Analysis of variance of the New Item SRRS yielded a significant effect due to age groups, F (3,156) = 9.77, $p < .001$. Between group comparisons were made using Duncan's New Multiple Range Test. The preschoolers' SRRS were significantly smaller than SRRS of the second graders, q (4,156) = 5.50, $p < .01$, sixth graders, q (4,156) = 3.00, $p < .05$, and adults, q (4,156) = 7.15, $p < .001$. While the adults produced larger SRRS than the sixth graders, q (4,156) = 4.15, $p < .001$, no differences were found in comparisons of New Items SRRS between second graders vs. sixth graders and second graders vs. adults. A trend analysis of the four age groups' New Item SRRS was undertaken. The linear component of the variation due to age groups was significant, F (1,156) = 13.89, $p < .001$, as was the cubic component, F (1,156) = 10.86, $p < .001$. The quadratic component was not significant, F (1,156) < 1, $p > .10$. The percent of the age group variance accounted for by the linear trend (47%) was greater than that accounted for by the cubic (37%) or quadratic (2%) trends; the percent of variance due to higher-order trends was 14. Correlations were computed between New Item SRRS and the number of correct responses with nonsignificant relationships for the preschool, second grade, and sixth grade groups, but significant relationships for the adult, r (38) = .45, $p < .01$, and overall group, r (158) = .33, $p < .001$.

EXPERIMENT II

Experiment I reinforced the notion that preschool children do not spontaneously produce the PRNI effect whereas children as young as those in second

grade do display PRNI. The question arises as to whether or not preschoolers can be taught to use the attentional strategy presumed to underlie the PRNI phenomenon. As hypothesized by previously cited authors, PRNI is the result of a strategy in which Ss discriminate New Items from Old Items during the presentation trial, pay special attention to the New Items during list learning, and emit the New Items prior to the Old Items on the recall trial before they are forgotten. Since the tasks involved in PRNI seem reasonably clear, the second experiment was performed to determine if preschoolers could be taught through verbal instruction to use the PRNI strategy in their FRL.

Method

Subjects, Lists and Procedure. The average age of the 40 middle-class Ss, 20 males and 20 females, was 4.7 years with a range of 3.8 to 5.6. Assignments of word lists, number of trials, presentation mode, presentation rate, and general instructions were, with one exception, exactly the same as those used in Experiment I. The exception was that the second experiment included the additional instructions for teaching Ss to use a PRNI strategy. Prior to each presentation trial after the first, Ss were encouraged, in terms familiar to them, to pay special attention to the words they didn't remember on the previous recall trial and to say these words first before they were forgotten. It was explained to the Ss that this method would assist them in remembering more words.

Results. Free recall learning was negatively accelerated with mean numbers of correct responses of 2.63 and 6.88 on Trials 1 and 7, respectively.

SRRS for New Items. On the average, 84% of the words in the 12-item list appeared at least one time during the seven recall trials. Results from an analysis of New Item SRRS with two levels each of testers, word lists, and sexes indicated that there were no main or interaction effects related to these

variables. The instructed preschoolers' mean New Item SRRS of .043, although in the direction of PRNI, was not significantly different from the median recall rank of zero, t (39) = 1.23, $p > .10$. There was, however, a significant correlation between the New Item SRRS and the number of correct responses, r (38) = .39, $p < .01$.

DISCUSSION

The results of the first experiment support the general notion that the use of the PRNI strategy increases with age. Most of the increase in PRNI was found to occur between the preschool years and the elementary school and adult years. The PRNI strategy, which was absent at the preschool level, was used as early as the second grade and continued to be used at the sixth grade and adult levels. The only difference among the second graders, sixth graders, and adults in amount of PRNI was that the adults produced more PRNI than did the sixth graders. The results of the second experiment which was designed to teach the PRNI strategy to a group of preschool Ss, are equivocal. Little evidence was found which would support the hypothesis that preschoolers can learn to use the PRNI strategy; on the other hand, one could legitimately argue that preschoolers could be taught the strategy if different instructions or procedures were used.

The present finding of PRNI in FRL of second graders, sixth graders, and adults under controlled conditions, is seen as strengthening the position that the PRNI effect is a valid phenomenon in its own right and not a product of serial-position bias. Furthermore, the fact that the amount of PRNI is directly related to age is viewed as supporting the notion (e.g., Battig et al., 1965) that PRNI reflects the use of a relatively sophisticated learning strategy, since one might expect older individuals to rely more heavily on such a strategy than younger individuals. There was some evidence (e.g., correlations between the New Item SRRS and amount of recall) that greater PRNI use results in increased recall.

The findings from the first experiment are at variance with Steinmetz and Battig's (1969) conclusions that increases in PRNI are not related to increases in age and that even very young children adopt an attentional strategy in FRL. It seems clear that the discrepancies between Steinmetz and Battig and the present study are largely due to the different reports of PRNI at the preschool level. It is the opinion of the present authors that the occurence of the preschool scores favoring PRNI in the Steinmetz and Battig study was a product of their lack of control for serial-position bias.

The absence of PRNI at the preschool level, and the presence of PRNI at the second grade, sixth grade, and adult levels, seem reasonable in light of the following account. Prior to the formal school years, individuals encounter relatively few situations that encourage the development of sophisticated learning strategies related to processing and organizing lists of items (i.e., words, symbols) to be recalled at a later time. This is not to say that preschoolers do not employ strategies when confronted with learning tasks such as the one used in the present study. On the contrary, preschool Ss have shown the use of different learning strategies in their FRL; among these strategies are the clustering of items in recall (e.g., Horowitz, 1969) and, at least in some instances, recalling the strongest items first (e.g., Newman and Edmonston, 1973). Indeed, the mere fact that preschoolers give any items at all in FRL argues that some kind of learning strategy is being used. What is being said in the case of learning strategies and preschoolers is that the demands made upon individuals prior to their entering school probably are not such that would require the development of complex memorization strategies like those involved in PRNI. During the first few years of school, however, individuals are faced with numerous tasks which require the acquisition and retention of large amounts of information. Perhaps it is the early experience with such

tasks that predisposes the individual toward developing sophisticated memory techniques which continue to be used through the college years.

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